Terminal Island Water Reclamation Plant
Advanced Water Purification Facility

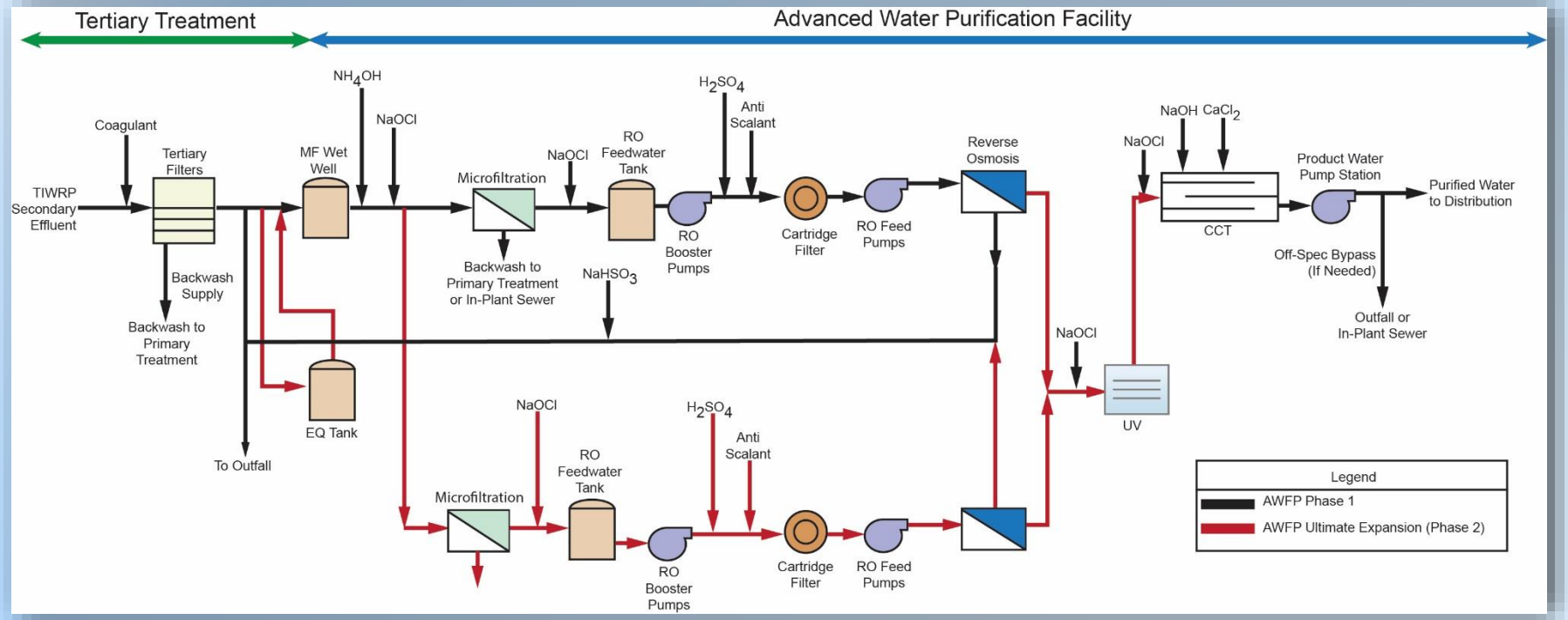
Completing the First Design-Build Potable Reuse Facility

carollo

Engineers...Working Wonders With Water®

LASAN Owns and Operates Terminal Island Water Reclamation Plant (TIWRP) and its Advanced Water Purification Facility (AWPF)

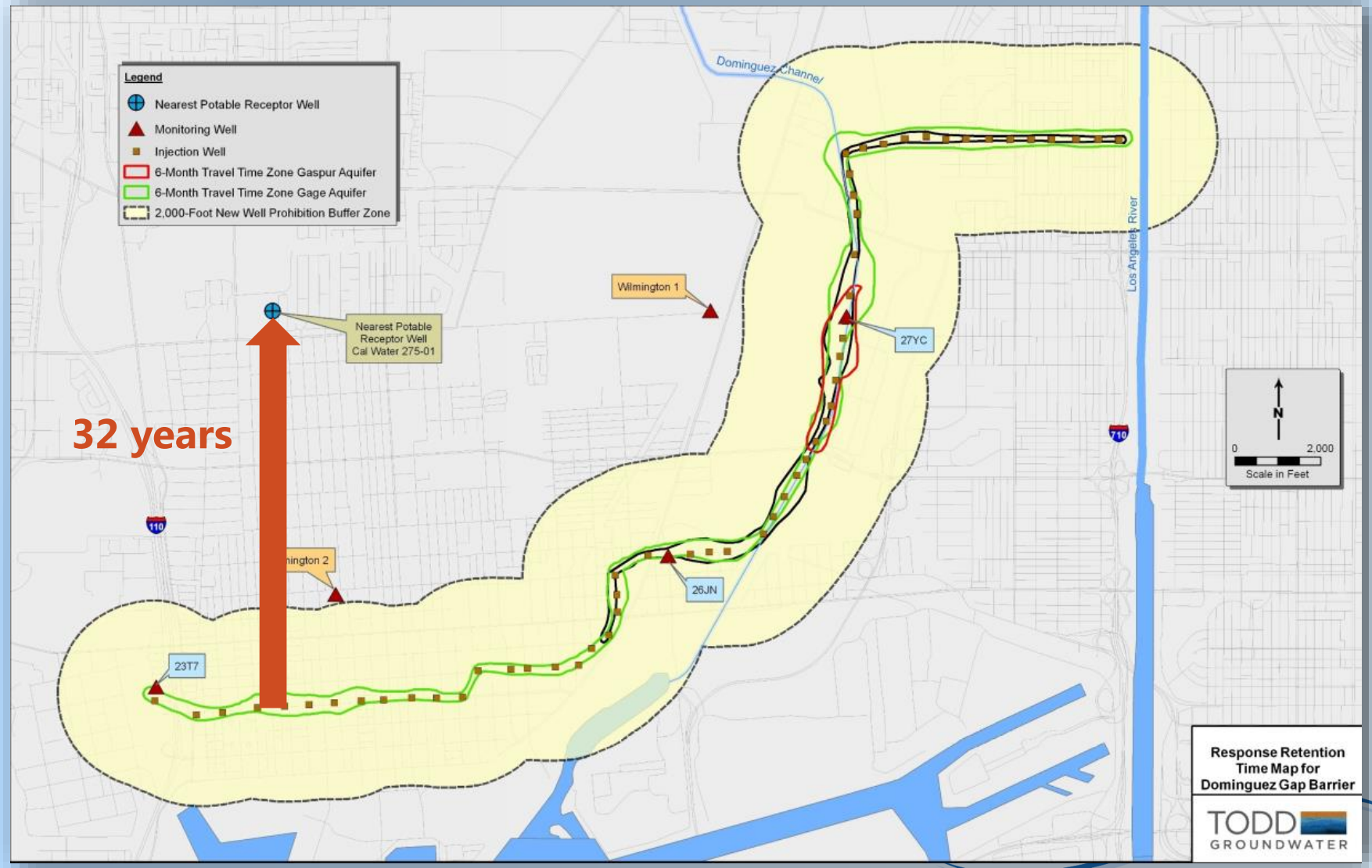
Phase 2 Expanded MF and RO and Added UV AOP to Produce 12 MGD of Purified Water



TIWRP AWPF Exceeds CCR Title 22 IPR Pathogen Requirements for Groundwater Replenishment - Subsurface Application

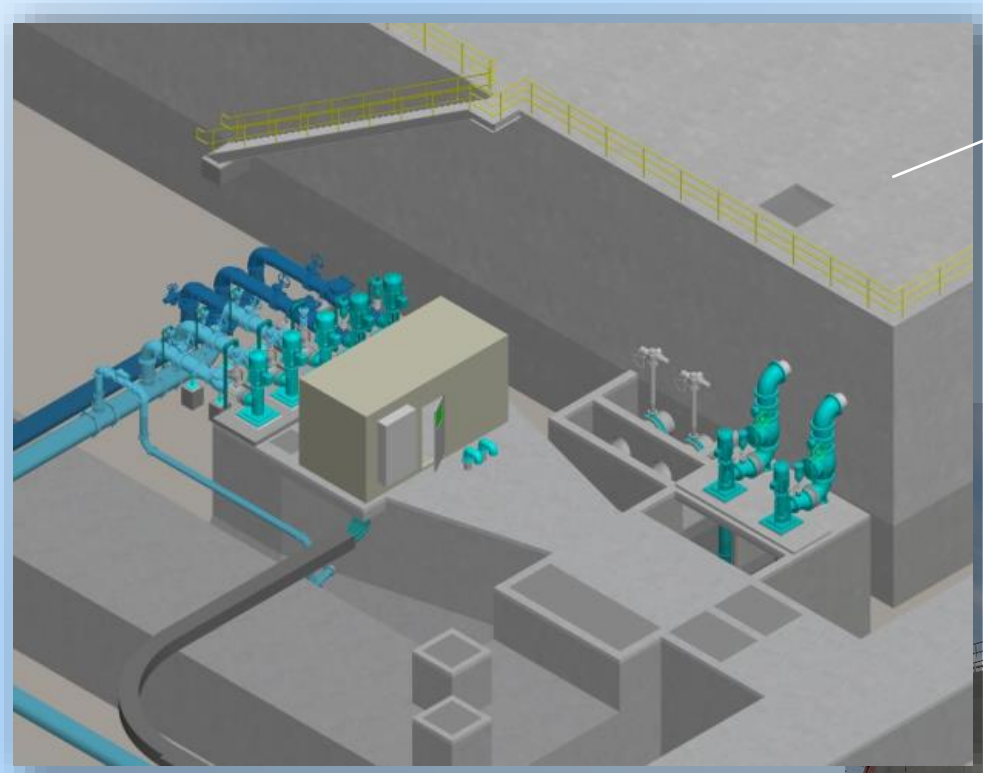
Process	Virus Log Removal	*Giardia* Log Removal	*Crypto* Log Removal
Primary and Secondary	1.9	0.8	1.2
Tertiary (Sand Filtration)	0.0	0.0	0.0
MF	0.0	4.0	4.0
RO	1.0	1.0	1.0
UV/NaOCl	6.0	6.0	6.0
Ct & Distribution	4.0	3.0	0.0
Subsurface Travel Time	6.0	0.0	0.0
Total	**18.9**	**14.8**	**12.2**
Required	**12**	**10**	**10**

Dominguez Gap Barrier Will Inject TIWRP AWPF Product Water at 100% RWC for IPR



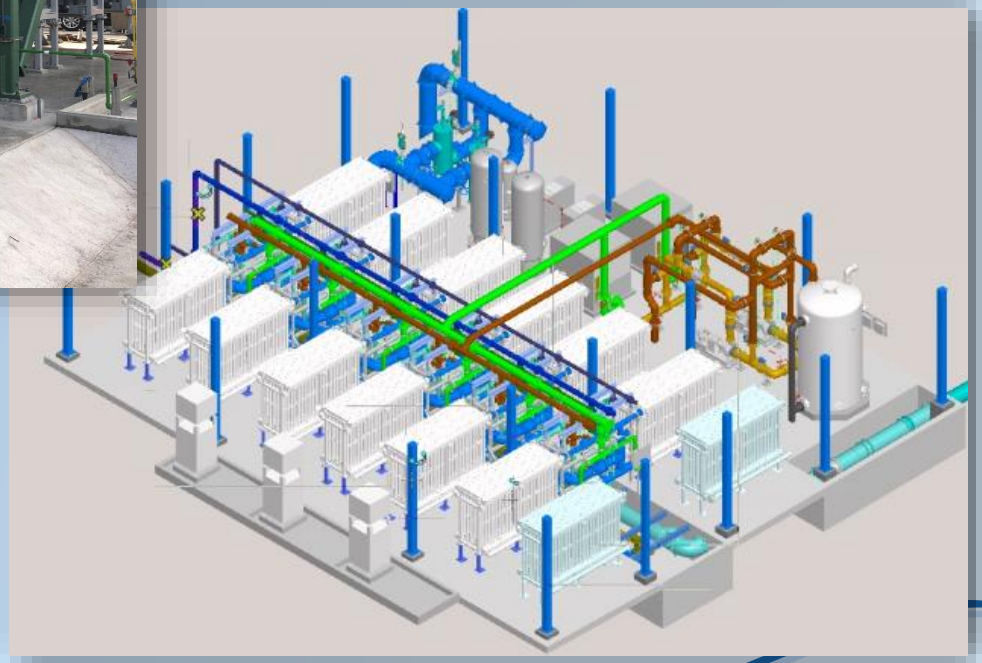
Process Changes

Equalization Tank to Dampen Diurnal Flow Variations in Tertiary TIWRP Effluent

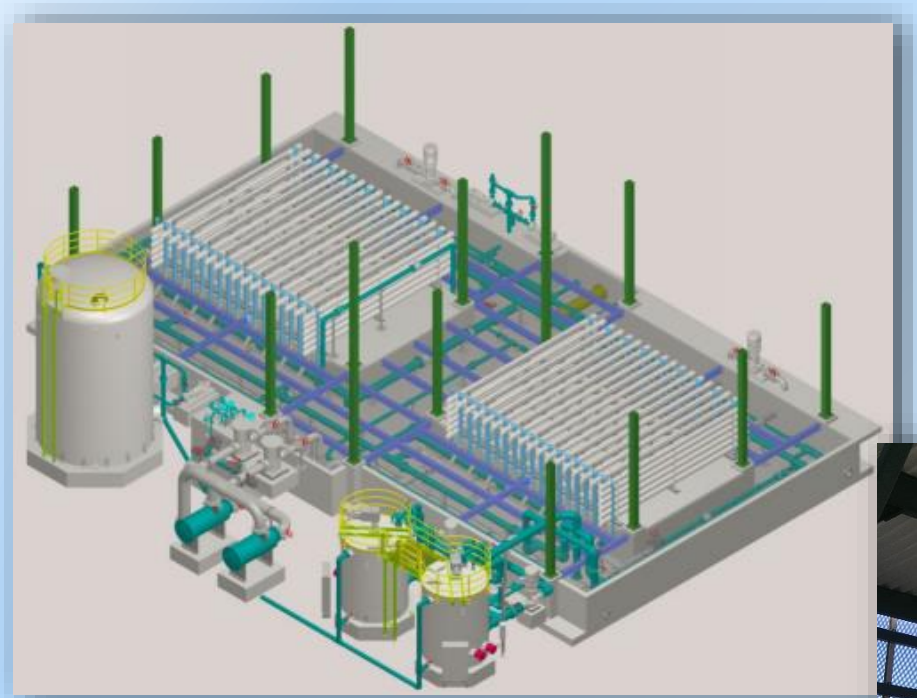


2.0 MG

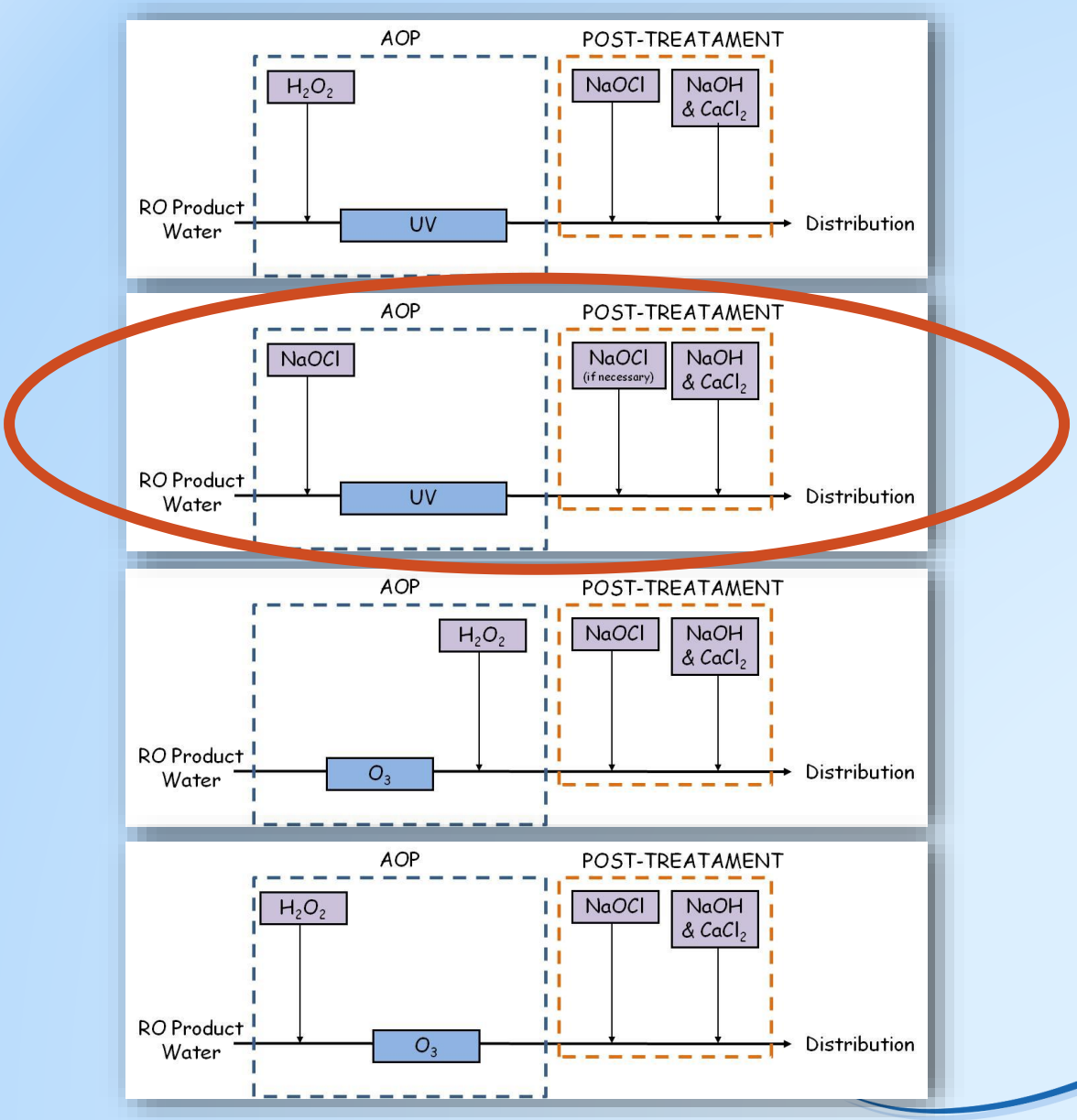
New PVDF Membranes for Expanded Microfiltration



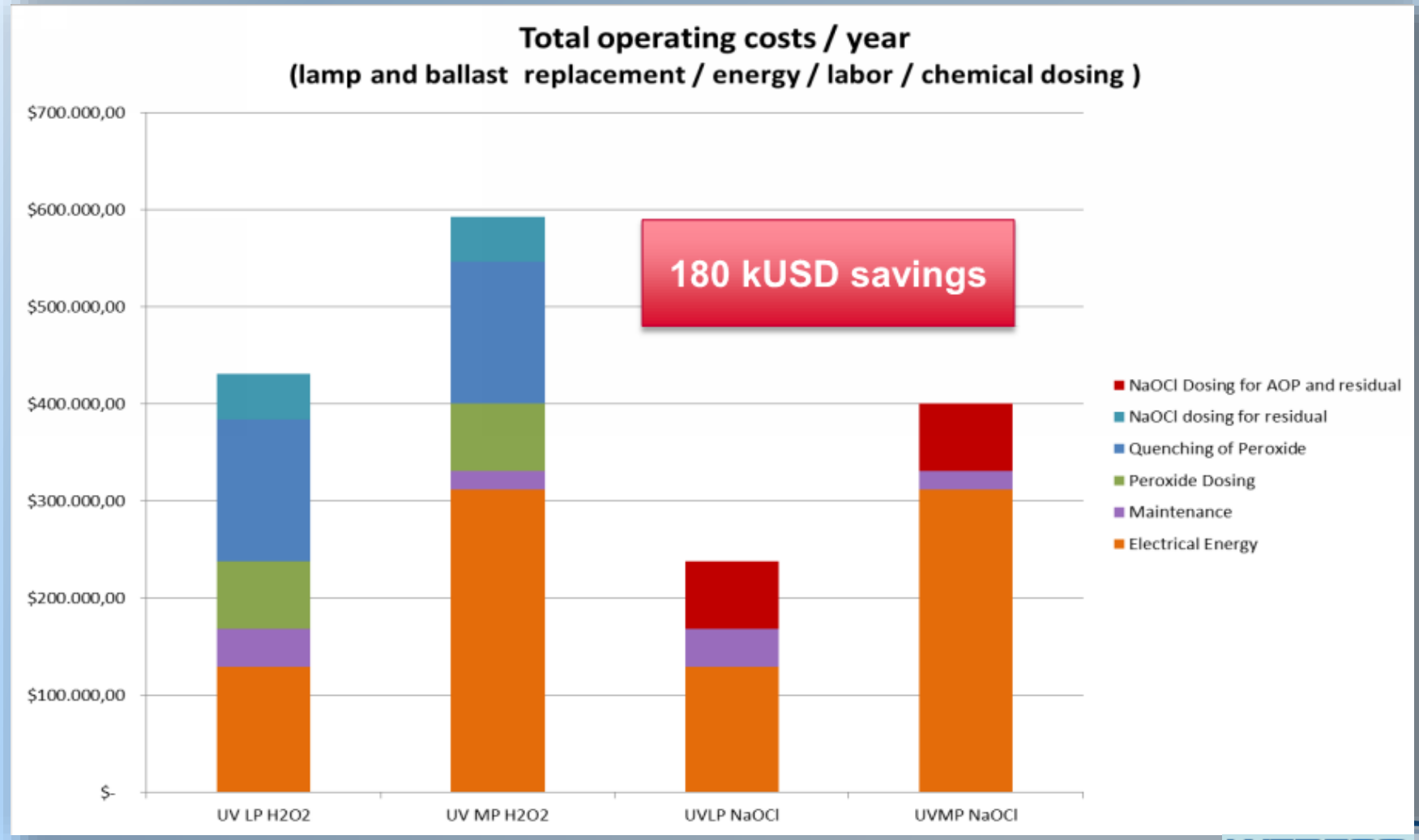
Expanded RO Capacity and Enhanced Monitoring



Benchtop and Pilot Studies to Determine AOP

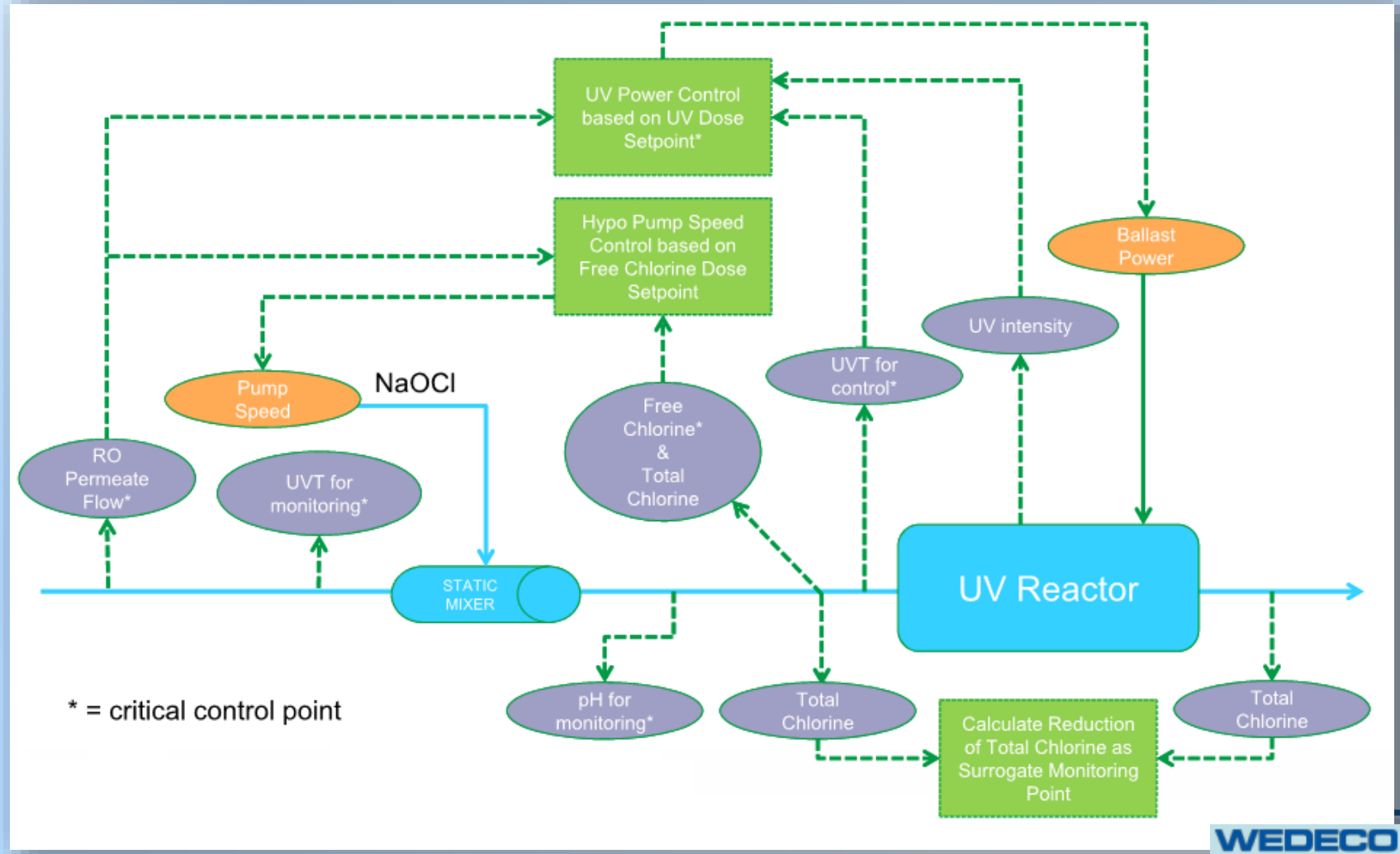


Low Pressure UV Coupled with Sodium Hypochlorite for Cost Effective AOP



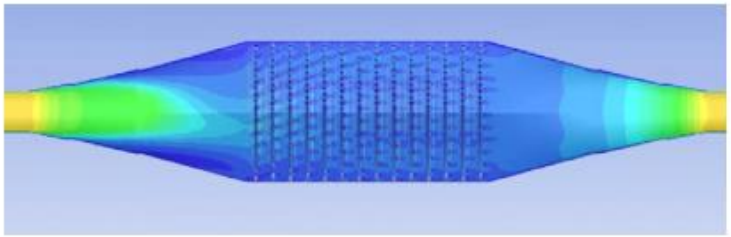
WEDECO
a xylem brand

UV AOP Critical Control Point Online Monitoring



WEDECO a xylem brand

UV Dose Control (instead of EE/O)



INPUTS

S = UV intensity sensor reading (per row)

UVT = UV transmittance

Q = Flow Rate

OUTPUTS

P = ballast power (same to each lamp)

Number of rows on

PLC

Basic Control Loop

$$Dose_{SP} = 920 \frac{mJ}{cm^2}$$

$$Dose_{CALC} = I_{avg} * t = MF * \frac{S}{F_T} * V/Q$$

If $Dose_{SP} - Dose_{CALC} > 0$, then increase P and/or turn on rows

If $Dose_{SP} - Dose_{CALC} < 0$, then decrease P and/or turn off rows

$Dose_{CALC}$

$V = irradiation\ volume = 0.480173\ m^3 * number\ of\ rows\ on$

$MF = a*(UVT)\text{^}6+b*(UVT)\text{^}5+c*(UVT)\text{^}4+d*(UVT)\text{^}3+e*(UVT)\text{^}2+f(UVT)+g$

$S = F_T * A * B^{UVA} * UVA^C * (1-(D*UVA^E/P))$

$F_T = fractional\ impact\ of\ adjacent\ rows$

The equations above were empirically fitted during UVDGM validation of K-reactor

UV AOP System

Finished Water Stabilization with Calcium Chloride and Sodium Hydroxide

Parameter	Value	RO Feedwater	RO Product Water	Stabilized Finished Water
Calcium	mg/L	101.0	0.5	30.4
Bicarbonate	mg/L	115.5	4.4	92.5
Carbon Dioxide	mg/L	59.8	65.5	0.9
Total Dissolved Solids (TDS)	mg/L	3,316	85	160
pH	--	6.5	5.0	8.2
LSI	--	-1.1	-6.2	0.1

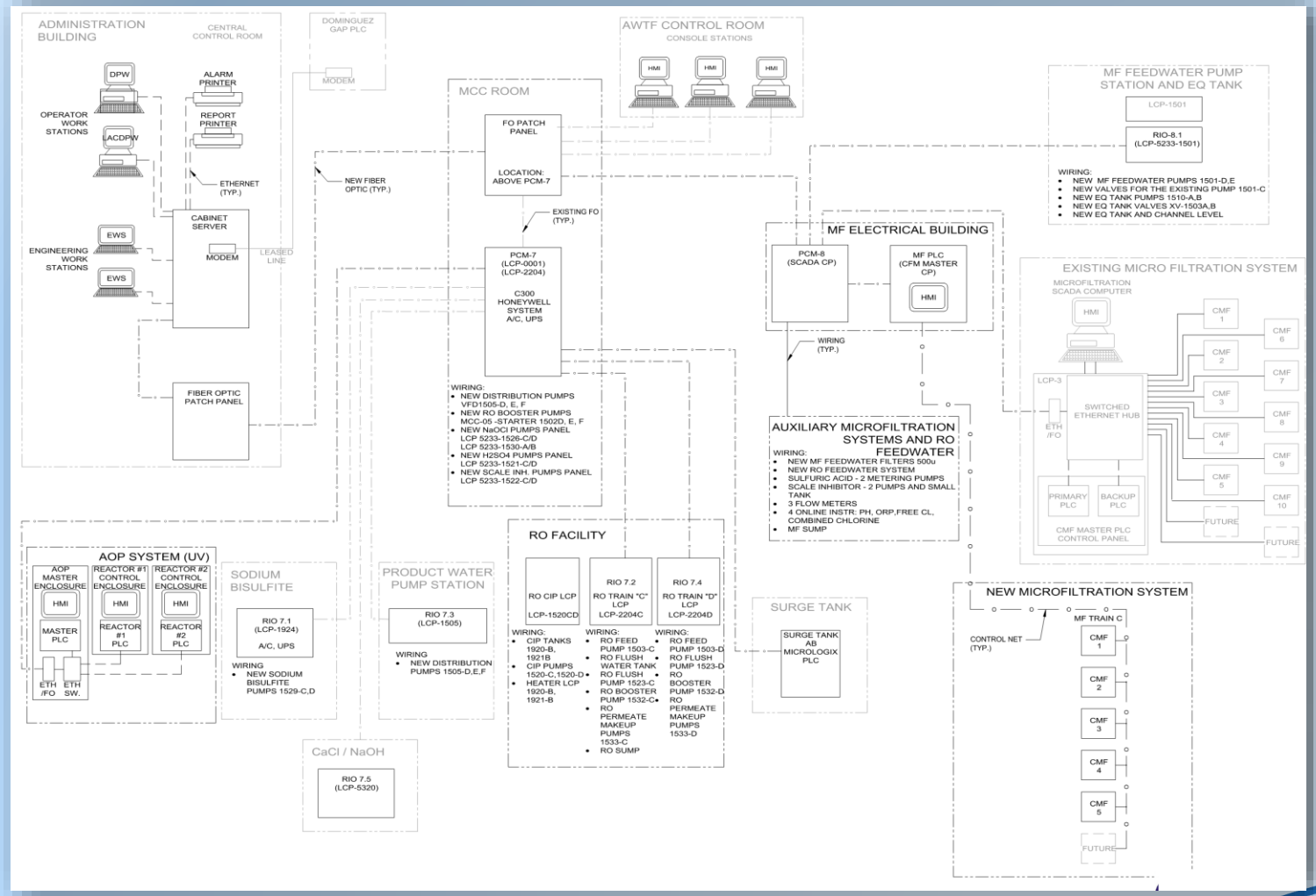
No Decarbonators

Construction Challenges

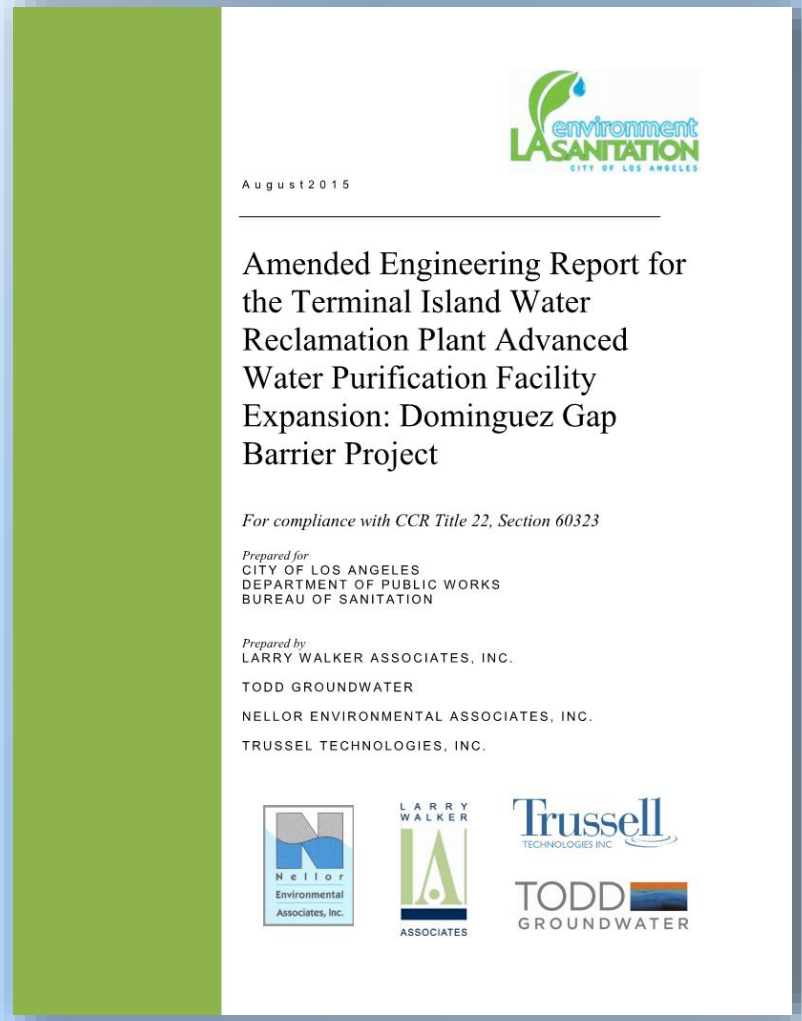
Cross-Connection Elimination during Construction

Congested Ductbank and Pipeline Routing on a Tight Site

Coordinating with DCS Integrator for Plant-wide Control System Reboot



Engineering Report finalized after Project went out to Bid



August 2015

Amended Engineering Report for the Terminal Island Water Reclamation Plant Advanced Water Purification Facility Expansion: Dominguez Gap Barrier Project

For compliance with CCR Title 22, Section 60323

Prepared for
CITY OF LOS ANGELES
DEPARTMENT OF PUBLIC WORKS
BUREAU OF SANITATION

Prepared by
LARRY WALKER ASSOCIATES, INC.
TODD GROUNDWATER
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TRUSSEL TECHNOLOGIES, INC.

In-Plant Critical Control Point Monitoring

Design Water	Parameter[1]	Type of Sample	Sampling Frequency	Alarm	Critical Limit
SE	BOD	24-Hr-Composite	Quarterly		
	TSS	24-Hr-Composite			
	TOC	24-Hr-Composite			
	Inorganic Minerals	24-Hr-Composite			
TE	Turbidity	Continuous	Continuous	NTU > 2	NTU > 5
	BOD	24-Hr-Composite	Quarterly		
	TOC	24-Hr-Composite			
	TSS	24-Hr-Composite			
MF Feedwater	Turbidity	Continuous	Continuous	Total Cl_2 > 1 mg/L Total Cl_2 < 3 mg/L	Total Cl_2 > 3 mg/L
	Total Chlorine	Continuous	Continuous		
	Temperature	Continuous	Continuous		
	ORP	Continuous	Continuous		
Phase 1 MF Product Water Phase 2 MF Product Water	Pressure Decay Test (PDT)	Continuous	1/day	LRV[2] 4.3 results in warning alarm	LRV[2] 4.0 results in shutdown and alarm
Phase 1 RO Feedwater Phase 2 RO Feedwater	Turbidity	Continuous	Continuous	NTU > 0.3 pH < 5.5 pH > 7.4	NTU > 0.5 pH < 4.0 pH > 7.4
	pH	Continuous	Continuous		
	Temperature	Continuous	Continuous		
	TOC	Continuous	Continuous		
	Conductivity	Continuous	Continuous		
	NH_3-N	24-Hr-Composite	Weekly		
	Inorganic Minerals	24-Hr-Composite	Weekly		
Phase 1 RO Product Water Phase 2 RO Product Water	Turbidity	Continuous	Continuous	NTU > 0.15 EC > 250 µS/cm	NTU > 0.20 EC > 350 µS/cm
	pH	Continuous	Continuous		
	Temperature	Continuous	Continuous		
	TOC[3]	Continuous	Continuous		
	Conductivity	Continuous	Continuous		
	NH_3-N	24-Hr-Composite	Weekly		
RO Brine	TSS	24-Hr-Composite	Monthly	NPDES Permit Requirements	
	Total Chlorine	Continuous	Continuous		
AOP Feedwater	Free Chlorine (monitoring)	Continuous	Continuous	Free Cl_2 < 2 mg/L Free Cl_2 > 4 mg/L	Free Cl_2 < 2 mg/L Free Cl_2 > 4 mg/L
	Total Chlorine (control)	Continuous	Continuous	Total Cl_2 < 2 mg/L Total Cl_2 > 4 mg/L	Total Cl_2 < 2 mg/L Total Cl_2 > 4 mg/L
	UV transmittance (UVT)[4]	Continuous	Continuous	UVT < 96%	UVT <96%
	pH (monitoring)	Continuous	Continuous	pH < 5.0 pH > 6.5	pH < 5.0 pH > 6.5
	Calculated UV Dose(control)	Continuous	Continuous	< 920 mJ/cm^2	<920 mJ/cm^2
AOP Product Water	Total Chlorine (monitoring/validation)	Continuous	Continuous	Total Cl_2 > 4 mg/L	Total Cl_2 > 4 mg/L
AWPF Product Water (Purified Water)	Turbidity	Continuous	Continuous	WDRs/WRRs Permit Requirements	
	Total Chlorine	Continuous	Continuous		
	pH	Continuous	Continuous		
	TOC	24-Hr-Composite	Monthly		
	Total Coliforms	Grab	Daily		

Notes:
1) Adopted from Table 14.1 of the Engineering Report.
2) Log Removal Value (LRV); for MF, MEMCOR® MEMBRANE Integrity testing per Membrane Filtration Guidance Manual EPA 815-R-06-009 (2005) based on PDT.
3) Confirmed with weekly grab sample.
4) UVT measurement upstream of NaOCl addition for monitoring. UVT measurement downstream of NaOCl addition for control.

Writing an Operator-Friendly Operation Optimization Plan

§60320.222. Operation Optimization and Plan.

(a) Prior to operation of a GRRP, a project sponsor shall submit an Operation Optimization Plan to the Department and Regional Board for review and approval. At a minimum, the Operation Optimization Plan shall identify and describe the operations, maintenance, analytical methods, monitoring necessary for the GRRP to meet the requirements of this Article, and the reporting of monitoring results to the Department and Regional Board. A project sponsor shall be responsible for ensuring that the

Treatment Process	Log Reduction Values (LRVs)			LRV requirements met when:	Equation Definitions	Train	DCS Tag	Related Instrumentation
	Viruses	Giardia	Crypto					
MF	0.0	4.0	4.0	$LRV_{DIT} = \frac{Q_P \bullet ALCR \bullet P_{atm}}{\Delta P_{test} \bullet V_{sys} \bullet VCF}$	Q_P = membrane unit design capacity filtrate flow (L/min) ALCR = air-liquid conversion ratio (dimensionless) P_{atm} = atmospheric pressure (psia) P_{test} = smallest rate of pressure decay that can be reliably measured and associated with a known integrity breach during the integrity test (psi/min) V_{sys} = volume of pressurized air in the system during the test (L) VCF = volume concentration factor (dimensionless)	MF Train A	CMF 1: TMFAHI4075B CMF 2: TMFAHI4105B CMF 3: TMFAHI4135B CMF 4: TMFAHI4165B CMF 5: TMFAHI4195B CMF 6: TMFAHI4405B	Calculated by the MFPLC based on analog inputs from: PIT-4077 PIT-4107 PIT-4137 PIT-4167 PIT-4197 PIT-4407
						MF Train B	CMF 1: TMFBHI4225B CMF 2: TMFBHI4255B CMF 3: TMFBHI4285B CMF 4: TMFBHI4315B CMF 5: TMFBHI4345B CMF 6: TMFBHI4375B	PIT-4227 PIT-4257 PIT-4287 PIT-4317 PIT-4347 PIT-4377
						MF Train C	CMF 1: TMFCHI0011B CMF 2: TMFCHI0012B CMF 3: TMFCPY0013C CMF 4: TMFCHI0014B CMF 5: TMFCHI0015B CMF 6: TMFCHI0016B	Calculated by the MFPLC2 based on analog inputs from: TBD

Schedule: Start Up Testing Coming Soon!

Walsh Construction

AWPF - Comissioning and Turnover Schedule

ACTIVITY / DESCRIPTION	April	May	June	July	August
Completion of Honeywell ORT / Honeywell Equipment Ready for Startup					
Shutdown to Tie in Evoqua RWP CP / RIO 8.1 (Neal / Evoqua)					
Upgrade Existing MCC's (Neal / GE)					
Tie in EQ Tank to MF Wetwell (Walsh)					
Wet Testing of MF Facility (Evoqua)					
Modify New MF O-rings (Evoqua)					
Delivery / Installation of Vertical Line Shaft Pumps					
Delivery / Installation of Horizontal End Suction Pumps					
Dry Testing of RO Facility RIO 7.2, 7.4 (Neal / Honeywell/Doosan)					
Chemical Facilities Installation/Start-up					
Startup Vertical Turbine Lineshaft Pumps EQ, PW, MF (Texas Turb)					
Startup Horizontal End Suction Pumps (Cortech)					
Wet Testing of RO Facility (Doosan)					
Wet / Dry Testing of AOP (Wedeco / Honeywell)					
Shutdown of AWPF for Integrating to New DCS 7.1, 7.3, 7.5 B's (Neal / Honeywell)					
Integration of 2204 and 0001 to PCM 7 (Neal / Honeywell)					
Exisitng MF Modifications (Evoqua)					
30 Day Performance Test					
30 Day Acceptance Test					

Plant Shutdowns
Existing 6 MGD Plant Capacity
New 6 MGD Plant Capacity
AWPF 12 MGD Plant Capacity
On Track

Questions?

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